Nongame Wildlife Program Grants
Project Summary/Abstract

Project Title: HABITAT USE, SPATIAL RELATIONSHIPS, AND CENSUSING TECHNIQUES OF BREEDING EASTERN BLACK RAILS (Laterallus jamaicensis jamaicensis) IN NORTHERN FLORIDA

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Summary/Abstract (limit to this page):
The eastern black rail (Laterallus jamaicensis jamaicensis) is among the most poorly known of the birds of Florida, hampering the potential for habitat manipulations to encourage the species. The proposed research will provide some of these data; with the objectives of determining habitat preferences of breeding eastern black rails on both the macrohabitat and microhabitat levels; determining home range size, changes in home range boundaries, and movements of eastern black rails during the breeding season; refining censusing techniques for eastern black rails; and determining general life history parameters of eastern black rails in Florida. The study will be conducted by a master's-level graduate student. A study site will be selected at one of several state or federal wildlife areas with tidal marsh habitat in northern Florida. Black rails will be trapped, fitted with radio transmitters, and tracked from fixed tracking stations using a computer assisted tracking system. Tracking will follow a systematic weekly schedule to avoid potential problems with independence of telemetric fixes. A cover map of the study site will be prepared from aerial photos and ground survey and will be digitized using a GIS system to determine distribution of cover types. Telemetric fixes of black rails will be superimposed over the cover map using the GIS system to determine cover type selection. Vegetative and physical habitat variables will be sampled at randomly selected sites and at sites intensively used by rails to characterize microhabitat selection. Home range boundaries of telemetered rails will be determined using the harmonic mean method. Sizes of home ranges will be compared among different seasonal categories and between sexes. Boundaries will be plotted to determine overlap and seasonal shifts in home ranges. Weekly surveys will be conducted using vocalization tapes to determine optimal timing and effects of weather variables on call counts. Telemetered birds will be monitored to determine movements of birds in response to tapes and the proportion of birds responding to tapes. Morphology, weight changes, sex and age criteria, molt, nesting biology, and food habits of black rails will be determined opportunistically from trapped and telemetered birds.

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Previous Research and its Relationship to the Proposed Work

Habitat of black rails has been characterized as being on the dry end of the wetland continuum (Fredrickson and Reid 1986). Cover types often mentioned as black rail habitat include Olney bulrush (*Scirpus olneyi*) and cattails (*Typha* spp.) at inland sites (Repking 1975, Repking and Ohmart 1977, Todd 1977), pickelweed (*Salicornia* spp.)-dominated high marsh on the west coast (Evens et al. 1986), and high marsh dominated by saltmeadow cordgrass (*Spartina patens*) in the East (Weske 1969). Cover type preference of California black rails appears to be merely an artifact of water depth in a given area, however (Flores and Eddleman 1990). Over 90% of all 430 habitat plots sampled at black rail use sites in Arizona were at sites with water ≤ 2 cm deep. No studies of eastern black rails have quantified selection of cover types or microhabitat characteristics of areas used by breeding birds (Weske 1969, Todd 1977). Preferred cover types and water depths at sites selected by black rails must be compared to availability in order to determine effects of water level manipulations and other wetland management practices commonly used for waterfowl management to determine optimum management for black rails.

An additional problem that has not received detailed study is the importance of adjacent upland habitat for black rails in salt marshes. Black rails in San Francisco Bay are exposed to predation by herons and other predators when they are driven out of marshes during high tide (Evens and Page 1986). A densely vegetated upland or high areas in the marsh may be essential to prevent excessive predation on black rails during these infrequent events. Telemetry would answer the question of where black rails move during high tides and what cover types they select during these tides.

be in error and therefore result in population overestimates. A second flaw with this technique is that not all rails respond to tapes at a given time. This proportion is only estimated at 40% for Yuma clapper rails (*Rallus longirostris yumanensis*), for example. If such data were obtained for black rails at different stages of breeding, calibrations of the technique could be used to refine population estimates.

Most aspects of the natural history of black rails are largely unknown, but available information is summarized in Bent (1926), Todd (1977), and Flores and Eddleman (1990). Because of time and personnel limitations for this proposed study, we will only collect these data opportunistically.

OBJECTIVES

The principal objectives of this study are to: 1) determine habitat preferences of breeding eastern black rails on both the macrohabitat (cover type) and microhabitat (selected vegetative and physical features) levels; 2) determine home range size, changes in home range boundaries, and movements of eastern black rails during the breeding season; 3) refine censusing techniques for eastern black rails, and 4) determine general life history parameters of eastern black rails in Florida.

METHODS

Most methods to be used in this study are designed to be compatible with a similar study conducted on California black rails in southwestern Arizona in 1987-88 (Flores and Eddleman 1990). Modifications may have to be made depending on the study site selected, unforeseen differences in the biology of eastern black rails, or the tidal nature of the habitat.

Study Area

A study area will be selected in northern Florida during fall, 1990. Ideal characteristics for a study site for the proposed research include a large number of black rails on a relatively small geographical area, diverse cover types within tidal salt marshes to better elucidate cover type and microhabitat preference by black rails, state or federal ownership to ensure access to the area for two field seasons, elevated roads or topographic relief for the optimal placement of tracking sites for the radiotelemetry portion of the study, nearby adequate housing for the graduate student and field assistant, ease of accessibility, and access to appropriate landmarks to facilitate survey of the area and preparation of a cover map. Possible study sites include St. Vincent, St. John's, and St. Mark's National Wildlife Refuges; the Big Bend Wildlife Management Area; or other sites identified during the recent surveys conducted by Nongame Wildlife Program biologists (Anonymous 1989).

Radiotelemetry Methods

Black rails will be trapped using drop-door traps placed along drift fences placed in areas where birds are calling or in suspected habitats. Drift fences will consist of 1-m tall sections of 1.2-cm mesh black plastic netting stapled to wooden surveyor's stakes. Traps will be constructed of 1.2 x 2.5-cm mesh welded wire, using 0.6-cm mesh hardware cloth for the treadle (Flores and Eddleman 1990). Traplines will be checked every morning and evening during daylight, more frequently when temperatures exceed 35°C. Most captures of black rails will be passive; that is, birds will encounter drift fences and walk into traps while attempting to find a way around the fence. Black rails respond readily to vocalization tapes the first time they are exposed to them (Anonymous 1989), so tapes may be used to attract birds to traplines.

Trapped black rails will be fitted with radio transmitters weighing ≤ 2 g and having a package life of ≥ 30 days (model SOPB-1038-LD available from Wildlife Materials, Inc., Carbondale Illinois, or equivalent). Any captured birds weighing <25 g will be banded and released, because experience with California black rails indicates birds lighter than this weight can experience problems with 2 g transmitters (Flores and Eddleman 1990). Transmitters will be attached to the skin and feathers of the back using cyanoacrylic glue in combination with eyelash cement (Johnson and Dinsmore 1985, Flores and Eddleman 1990). Transmitters fitted on black rails in this manner usually drop off in 2-6 weeks (Flores and Eddleman 1990), so transmitters will be recovered and re-used after being fitted with fresh batteries. Up to 40 birds will be telemetered annually, including both breeding adults and independent juveniles.

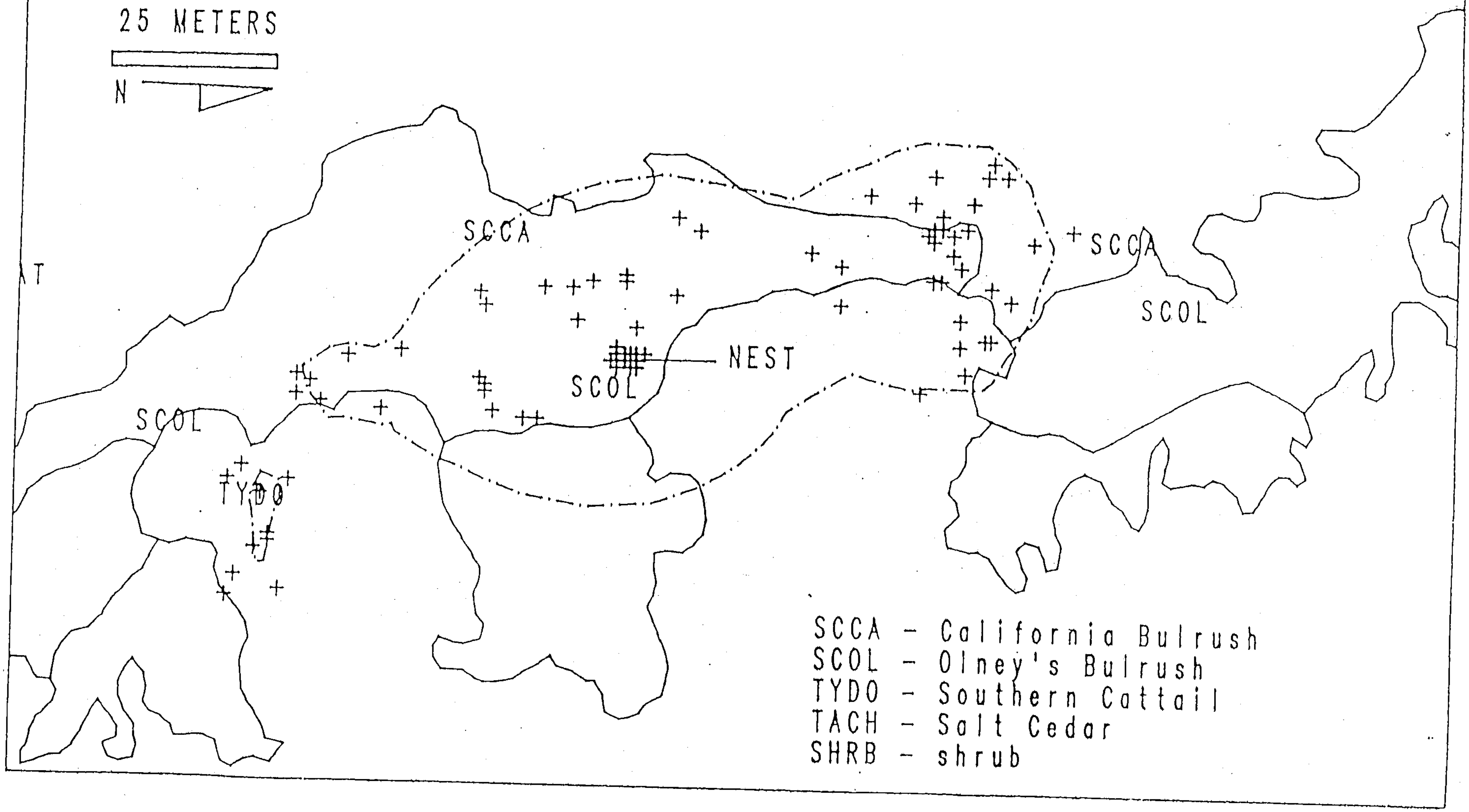
Because black rails can be very active within a small home range area (Flores and Eddleman 1990), a highly accurate telemetry system is necessary to provide valid results for habitat sampling and spatial analyses. Accordingly, at a given time birds will be tracked from mobile tracking stations placed at two of several fixed points. Error estimates for each fixed point will be obtained by simultaneously obtaining an azimuth on an assistant carrying a transmitter at a series of points in the area of interest (one at about every 3^{o}). The standard deviation of differences between surveyed/telemetric points will provide a basis for an error term in the computer software described below (Biggins et al. 1985). Tracking station sites, beacon transmitter sites, and other landmarks will be surveyed initially and their coordinates converted to Universal Transverse Mercator (UTM) coordinates. All telemetric fixes will be recorded as UTM coordinates.

When tracking a bird, two assistants will be placed at different tracking stations. They will determine azimuths for 2 or 3 beacon transmitters at the beginning of each tracking session to calibrate a compass rose at each station. Simultaneous azimuths will be obtained on each telemetered bird from the two stations during tracking and the assistants will communicate via two-way radios. The results will be entered into a Toshiba Model T-1000 portable computer and analyzed using TRITEL, a telemetry triangulation program (D.E. Biggins, U.S. Fish and Wildlife Service, Fort Collins, CO 80524). This program uses the UTM coordinates of the tracking stations and azimuths to calculate UTM coordinates for the birds. Bird identification numbers, date, time, UTM coordinates, and size of error polygons will be stored in the computer for later analysis. If signals of telemetered birds disappear without explanation, searches for the birds will be conducted outside the intensive study site.

Habitat Use

A cover map of the study area will be prepared using available aerial photography augmented with a ground survey. All mapable cover types and their boundaries will be included. The map will be tied to a UTM grid by survey to known points on the ground. The cover map will be digitized using equipment available from the Rhode Island Geographic Information System (RIGIS) using ARC/INFO. To determine cover type preference of black rails, home range boundaries and associated telemetric fixes collected during the spatial relationships segment of the study will be superimposed on the cover map. Availability of cover types will be calculated within the boundary of each home range using the RIGIS software, and habitat use will be determined from the number of fixes occurring in each cover type within the home range (Fig. 1). Each of these results will be used as data points for calculation of overall cover type preference (Johnson 1980). Cover types will be classified as selected in a proportion greater than expected by their availability, selected in proportion to their availability, or avoided relative to their availability.

Figure 1. Spatial overlap between a harmonic mean home range and its associated point overlay for a nesting female Black Rail during June 1988



Separate preference calculations will be made for the pre-breeding, nesting, brood-rearing, and postbreeding periods if sample sizes are large enough.

Characteristics of microhabitat will be obtained at randomly selected points and at sites intensively used by black rails. At least 30 random points will be selected each month by generating random pairs of UTM coordinates and locating the points in the field. At each point a 0.25-m^2 plot will be sampled. Variables measured will include total substrate coverage by emergent vegetation, residual vegetation, bare ground, and water; water depth; mean height of emergent vegetation; distances to cover type change, open water, upland vegetation, and dry ground; and stem density of each emergent plant species.

Monthly files of telemetric fixes will be used to choose sites intensively used by individual birds using the program INTENS (D.E. Biggins, U.S. Fish and Wildlife Service, National Ecology Center, Fort Collins, Colorado). This software allows selection by the user of a grid spacing system of varying size to be superimposed on the study area or a subset of it. The spatial distribution of fixes can then be used to select intensively used grid cells. A grid spacing of 10 m and the definition of a "used" cell as having at least four fixes in the cell on three or more days within a month should be adequate for black rails.

To locate a cell, an assistant carrying a transmitter will be tracked to the center of the cell. Program TRITEL will be used to determine when the assistant is at the center of the cell. Four to 12, 0.25-m^2 plots will be sampled in each grid cell, depending on the relative number of fixes plotted in each cell, and will be located by generating random numbers of ≤ 5 m along the four cardinal directions from the center of the cell. Characteristics of the random and used sites will be compared using analysis of variance and Wilcoxon signed-rank tests in the Statistical Analysis System (SAS Institute, Inc. 1985). Results of general cover type use and microhabitat comparisons will be related to habitat management techniques using published literature, especially as they relate to waterfowl management (Eddleman et al. 1988).

Because of the importance of water depth to rails in general and black rails in particular (Fredrickson and Reid 1986, Eddleman et al. 1988), water depth will be monitored at selected points throughout the study area using depth stakes marked at 2-cm intervals. These stakes will be monitored intensively at high tides to determine maximum water depth tolerated by black rails.

Spatial Relationships

The mis-timing of radio tracking can result in both missing valuable information on rail movements and home range usage (Eddleman 1989), or violating the statistical assumptions of home range calculation (Swihart and Slade 1985). Accordingly, telemetered birds will be tracked on a systematic schedule on a weekly basis. This schedule will divide a 24-hr day into six time periods--early morning (beginning ½ hr before dawn), late morning, midday, early afternoon, late afternoon (ending ½ hr after sunset), and night. Each of these periods will be randomly assigned to the days of the week such that each period is covered once per week. Alterations may occur if special environmental factors warrant tracking at other times. For example, extreme high tides can force black rails out of preferred cover types, which exposes them to predation (Evens and Page 1986); tracking will have to be timed to coincide with these tides. Individual tracking sessions will last for at least three hours per day.

Home range size will be determined using the harmonic mean method (Dixon and Chapman 1980) in the program HOME RANGE (Ackerman et al. 1989). Telemetric fixes for each bird will be segregated into separate files, and data will be separated further into seasonal files before analysis. Seasons considered will be: pre-breeding/courtship, nesting/incubation, brood-rearing, and postbreeding. Separate home range sizes also will be calculated before and after major movements by individual birds. After tracking data on individual birds are separated into seasonal files, an initial run of the program will be conducted to check for proper scale, test for independence of observations, and to identify fixes that were outside the normal home range (outliers) (Samuel et al. 1985a). In cases where the scale selected is too small, the scale will be enlarged and the program will be run again. If non-independence of fixes is indicated, the sampling interval will be increased by eliminating fixes obtained at too small a time interval (Swihart and Slade 1985). Outliers then will be given a zero weight in the data files and a final run will be conducted. In the final run, program options will be invoked to identify significantly used (core) areas (Samuel et al. 1985b), and to calculate harmonic mean home ranges and minimum convex polygon home ranges (Hayne 1949). The 95% harmonic mean contour home range will be used in all home range calculations because it provides an estimate most closely attuned to rail spatial use (Eddleman 1989). Home ranges will be plotted on the cover map to elucidate overlap among home ranges, seasonal shifts in home range centers, and shifts in home range boundaries with changes in breeding status.

Home range and core area sizes among seasonal and bird sex categories will be compared using Mann-Whitney U-tests (Conover 1980) with a significance level of $\underline{P} = 0.05$. Signal fluctuation data will be summarized for each hour of the day to determine diel activity patterns. Seasonal movements and daily activity patterns will be presented as descriptive phenomena as summarized from tracking data.

Censusing Techniques

Permanent stations will be established on the study area from which surveys of black rails will be conducted. To conduct these surveys, one-minute continuous loop tapes of black rail and Virginia rail vocalizations will be used to elicit responses from black rails. Black rail tapes will include two series of "kicky-doo" vocalizations and one series of "grr" vocalizations, and Virginia rail tapes will include two series of "grunt" vocalizations and one series of "ticket" vocalizations. Alternating the tapes might increase the response rate of black rails (Johnson and Dinsmore 1986), and the degree of response to black rail and Virginia rail tapes will be compared.

Tapes will be played on a Johnny Stewart game caller with power horn amplifier; the sound approximates 90 dB immediately in front of the power horn (Johnson and Dinsmore 1986). The black rail tape and the Virginia rail tape will be played for two minutes at each station (total of four min/station). All responses by black rails will be recorded at each station, but individuals suspected of responding more than once will be noted and eliminated from the total number of birds counted. Call-counts will be conducted April through August at both study areas. In order to determine the optimal diel timing of call counts, paired morning and evening counts will be conducted once weekly. The total response of separate birds will be recorded for each week and analyzed using Wilcoxon signed rank tests to determine optimal timing of call-counts to obtain the maximum number of responses. Weather variables will be noted during each call count in order to determine their effect on black rail response rates. These will include cloud coverage, temperature, wind speed and direction, precipitation, barometric pressure, and tidal stage. Weather variables will be analyzed within seasonal time periods related to the vocalization behavior of birds (courtship/pairing, nesting, brood rearing, postbreeding) or within time periods related to the general level of vocalizations occurring on the study area (cf. before peak, during peak calling, after peak calling).

During each call-count, each telemetered bird present in the area covered by the call count will be located using a three-element hand held yagi antenna and receiver. Response to tapes by these birds will be recorded from the call-count station nearest the bird. The resulting response/no response data will be analyzed weekly, and by breeding status in some cases. This will allow determination of the proportion of birds responding to tapes during a call-count, the number of counts needed to obtain complete counts of birds, and confirmation of optimum seasonal timing for call counts (cf. Bart et al. 1984). Additionally, these data will be used to calibrate variable circular plot census techniques suggested for black rails in order to refine density estimation (Evens et al. 1986). The distance moved by selected telemetered individuals in response to taped vocalizations will also be determined by tracking these birds during call counts to allow refinement of the technique used by Evens et al. (1986).

Life History

Various aspects of the life history of black rails in addition to those described above will be determined opportunistically. These will include morphology, the annual pattern of weight changes, sex and age criteria, molt patterns, nesting biology, and food habits. Weights, standard measurements, molt data, and soft part colors (Smithe 1975) will be recorded for each bird captured and for all recaptured birds. Nests will be located by monitoring locations of nesting telemetered birds and by systematic nest searches. Each nest located will be monitored every two days to determine nest success. Additionally, any telemetered birds known to be nesting will be monitored intensively to determine incubation patterns. Food habits of black rails will be determined from fecal material collected from trapped birds. Feces will be stored in preservative and analyzed in the lab. The resulting information will give only a listing and relative abundance of food items, of foods, but will improve knowledge of resources exploited by black rails. Unless sample sizes are larger than anticipated, most of the data from this section of the project will be reported as descriptive phenomena.

PROJECT SCHEDULE

Time period	Task(s)
20 Feb. 1 Jan.-28 Feb. 1992	Selection of senior technician
1 Jan.-14 Apr. 1992	Screen potential study sites; make an initial trip to study site; select study site; obtain aerial photos of study site and prepare rough cover map; obtain equipment for telemetry (transmitters, antennae, computer, receivers); select field assistant; begin preparation of cover map; and adapt computer software to available system for telemetric monitoring
15 Apr.-15 May 1992	Construct traps and begin trapping and telemetering birds; ground truth and complete cover map; survey and select monitoring sites for fixed tracking stations; and begin data collection for all phases of the project
16 May-15 Aug. 1992	Continue data collection; conclude first field season
16 Aug.-31 Dec. 1992	Data entry; revision of study plan to account for unforeseen problems or opportunities; digitize cover map; and begin data analysis
1 Jan.-14 Apr. 1993	Repair equipment; obtain transmitters; select field assistants; prepare computer software; and analyze 1991 data.
15 Apr.-15 Aug. 1993	Data collection for second field season
16 Aug.-30 Nov. 1993	Data entry and analysis; preparation of draft final report
1 Dec. 1993-30 June 1994	Completion of final report; manuscript preparation

PROJECT SCHEDULE

Time period	Task(s)
1 Jul.-31 Aug. 1990	Selection of graduate assistant and initial screening of study sites
1 Sept.-31 Dec. 1990	Final selection of study site; graduate student coursework; and preparation of detailed study plan
1 Jan.-14 Apr. 1991	Make an initial trip to study site; obtain equipment for telemetry (transmitters, antennae, computer, receivers); select field assistant; prepare rough draft of cover map; and adapt computer software to available system for telemetric monitoring
15 Apr.-15 May 1991	Construct traps and begin trapping and telemetering birds; ground truth and complete cover map; survey and select monitoring sites for mobile tracking stations; and begin data collection for all phases of the project
16 May-15 Aug. 1991	Continue data collection; conclude first field season
16 Aug.-31 Dec. 1991	Graduate student coursework; revision of detailed study plan to account for unforeseen problems or opportunities; digitize cover map; and begin data analysis
1 Jan.-14 Apr. 1992	Graduate student coursework; repair equipment; obtain transmitters; select field assistant; prepare computer software; and analyze 1991 data.
15 Apr.-15 Aug. 1992	Data collection for second field season
16 Aug.-30 Nov. 1992	Graduate student coursework; data analysis; and preparation of draft final report
1 Dec. 1992-31 May 1993	Completion of final report/thesis; final graduate student coursework; and manuscript preparation

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